(12) UK Patent Application (19) GB (11) 2 330 446 (13) A

(43) Date of A Publication 21.04.1999

(21) Application No 9816186.2

(22) Date of Filing 27.07.1998

(30) Priority Data
(31) 9716252 (32) 01.08.1997 (33) GB

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(51) INT CL[6]
G11B 27/036

(52) UK CL (Edition Q)
G5R RB81

(56) Documents Cited
GB 2306750 A GB 2300535 A GB 2266037 A
EP 0625782 A2

(58) Field of Search
UK CL (Edition P) G5R RB81
INT CL[6] G11B 27/028 27/029 27/031 27/036
ONLINE: WPI, EDOC, JAPIO

(54) Abstract Title
Editing image data

(57) Image data representing image frames are edited. Segment data is stored and image frames are displayed in response to this segment data. A visual display displays visual elements 304,305 representing adjoining image segments in response to the segment data. A manual input device selects and adjusts transitions between adjoining segments so that the segment data is modifiable in response to these adjustments. The system is configured to selectively operate in a linked mode or in an unlinked mode. In the linked mode, movement 314 of a transition 315 between adjoining segments maintains the segments as being adjoining by adjusting the lengths of both of the segments. In the alternative unlinked mode, movement of a transition results in the length of one of the segments 305 being modified while its adjoining segment 304 retains its original segment length.

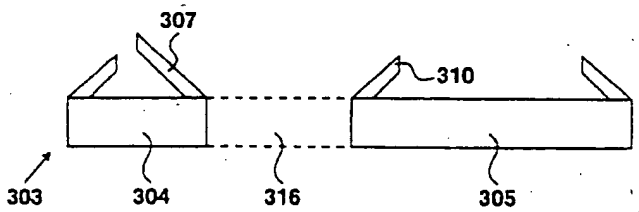

Figure 3

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Application No: GB 9816186.2 **Examiner:** Peter Easterfield
Claims searched: 1 to 17 **Date of search:** 16 December 1998

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): G5R (RB81)

Int Cl (Ed.6): G11B 27/028, 27/029, 27/031, 27/036

Other: Online: WPI, EDOC, JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X,Y	GB 2306750 A	(QUANTEL)	1-17
X,Y	GB 2300535 A	(QUANTEL)	1-17
X,Y	GB 2266037 A	(QUANTEL)	1-17
Y	EP 0625782 A2	(SONY)	1-17

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

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Editing Image Data

The present invention relates to an apparatus for editing image data representing a plurality of image frames. The present invention also relates to a method of editing image frames.

Systems are known for editing image data in which the data is represented by digital data samples. In the majority of systems, editing of this type is performed on a low resolution version of the data, allowing the operations to be performed using relatively modest equipment. At the end of an editing session, the system is configured to produce a machine readable edit decision list which may then be used to control an on-line editing operation at full definition.

Systems which provide for the editing of images in the form of machine readable data allow the data to be accessed from disc such that an editor may quickly move to a particular frame without running through the entire length of a tape. In this way, the perceived distance between frames is non-linearly related to their temporal displacement along a notional reel, usually represented by timecode, and for this reason systems of this type are often referred to as being "non-linear".

Non-linear editing suites provide many advantages over traditional editing methods and a demand has therefore been created for providing non-linear facilities at full definition, thereby providing non-linear on-line editing. Such facilities are required to handle video clips at full definition and as such require significant levels of storage in combination with highly powered data processing engines. Consequently, the overall cost of such systems, when compared to similar off-line environments, is relatively high therefore on-line editing procedures need to be performed quickly and accurately, with many tools being made available to an operator, thereby making the overall procedures as efficient as possible.

When editing clips of cinematographic film, the clips are made physically available to an editor and as such may be manipulated independently until a physical join is made as part of the editing process. In a non-linear editing environment, clips are merely represented on a visual display unit and all manipulations to these clips must be implemented using manually controllable interface devices. Thus, in known environments, situations exist in which operations performable upon physical lengths of cinematographic film or physical lengths of video tape do not immediately have a parallel within the non-linear editing environment.

According to a first aspect of the present invention, there is provided an apparatus for editing image data representing a plurality of image frames, comprising storage means for storing segment data; output means for displaying image frames in response to said segment data; visual display means for displaying visual elements representing a joining of image segments in response to said segment data; manual input means for selecting and adjusting transitions between joining segments such that said segment data is modifiable in response to said adjustments; and processing means configured to selectively operate in a linked mode or in an un-linked mode, such that in said linked mode movement of a transition between adjoining segments maintains said segments as being adjoining by adjusting the lengths of both of said segments, and in said un-linked mode movement of a transition results in the length of one of said segments being modified while its adjoining segment retains its original segment length.

In a preferred embodiment, the storage means is configured to store a data block for each segment, including a start time and an end time for said segment. A processing means may be configured to update two data blocks when segments are linked and configured to update only one data block when said segments are un-linked.

According to a second aspect to the current invention, there is provided a method of editing image data representing a plurality of image

frames, comprising steps of storing segment data; displaying image frames in response to said segment data; displaying visual elements representing adjoining image segments in response to said segment data; selecting and adjusting transitions between adjoining image segments such that said segment data is modifiable in response to said adjustments; and selectively operating in a linked mode or in an un-linked mode, such that in said linked mode movement of a transition between adjoining segments maintains said segments as being adjoining by adjusting the lengths of both of said segments, and in said un-linked mode movement of a transition results in the length of one of said segments being modified while its adjoining segment retains its original segment length.

In a preferred embodiment, movement data is converted into representations of timecode. Preferably, an attribute of a displayed icon is changed in dependence upon a selected mode of operation.

The invention will now be described by way of example only, with reference to the accompanying drawings, in which:

Figure 1 shows an on-line non-linear editing suite, having a processing unit, a frame storage device, a visual display unit and manually operable input devices;

Figure 2 illustrates operations performed within the edit suite identified in *Figure 1*, including the editing of video clips;

Figure 3 illustrates modifications to a video clip;

Figure 4 illustrates an image display to an operator while performing a linked edit;

Figure 5 illustrates an image shown to an operator during an un-linked edit;

Figure 6 illustrates the formatting of segment data within a track file;

Figure 7A, *7B* and *7C* illustrates the editing of frames within a clip;

Figure 8 details the editing of track segments identified in *Figure 2*, including a step for updating segment data;

Figure 9 details the segment updating step identified in *Figure 8* for linked edits;

Figure 10 illustrates the updating of the data shown in *Figure 6* in response to the procedures shown in *Figure 9*;

Figure 11 details the updating of segment data in the unlinked mode; and

Figure 12 shows the updating of the data shown in *Figure 6* in response to the procedure identified in *Figure 11*.

An on-line editing facility is shown in *Figure 1*, in which video source material is captured from video tape **101** via digital video tape recorders **102**. The capturing process involves the transfer of the video material to an array of magnetic disk storage devices **103**, in which full definition video signals are transferred in real time by a process of striping video images across a plurality of disk drives.

The transfer of information and the processing of data occurs within a computer **104** such as an ONYX manufactured by Silicon Graphics Inc. and including executable instructions for performing editing functions in response to operator commands. These executable instructions may be loaded into the ONYX system by means of a suitable computer readable medium, such as CD ROM.

Operator commands are generated by a stylus **105**, a keyboard **106** and a mouse **107**. Video images are displayed on a visual display unit **108** which presents the video clips and other graphical information within a graphical user interface. In addition, video images may also be supplied to a broadcast quality monitor **109** with audio signals being supplied to loudspeakers **110** and **111**.

Operations performed by the editing environment identified in *Figure 1* are detailed in *Figure 2*. At step **201** an edit decision list is loaded to processing system **104**, usually by inserting a floppy disk or, alternatively, by receiving an EDL file over a data network.

In response to commands within the edit decision list, an operator is prompted to insert appropriate video tapes **101** into a video tape recorder so that the processing system **104** and the disk array **103** may perform a capturing process at step **202**.

After the data has been captured, the edited video is displayed to the operator on visual display unit **108** in the form of track segments at step **203**.

At step **204** track segment edits are performed in response to operator commands and after making these edits, video material is previewed at step **205**. The previewing of video material is displayed on the visual display unit **108** and is also displayed on monitor **109**. In addition, any audio tracks associated with the video may be directed to loudspeakers **110** and **111**. Thus, the environment provides a facility in which editing operations may be performed on both the video track and the audio tracks.

A question is asked at step **206** as to whether the preview has been successful and if answered in the negative, steps **204** and **205** may be repeated. By answering the question at **206** in the affirmative, the newly created video material may be recorded on a new video tape using one of the video tape recorders **102**.

The editing of track segments at step **204** allows the segments to be edited in one of several selectable modes of operation, to be described subsequently. The editing apparatus is arranged to represent many image frames which are stored at full definition on the disk array **103**. In addition, a representation of these frames is stored as segment data within the processing system **104** using its own local storage facilities. An output is generated by processing system **104** which is supplied to the visual display unit **108** representing image frames in response to the stored segment data. Thus, segments displayed on visual display unit **108** may be modified resulting in an appropriate display of video data from disk storage **103**. Visual display unit **108** displays visual elements representing adjoining image segments in response to the segment data stored by the processing system

104. An operator uses stylus **105** or mouse **107** to select and adjust transitions between adjoining segments resulting in the segment data stored by processing system **104** being modified.

The processing system **104** includes executable instructions arranged to configure the system such that it may selectively operate in a link splice mode or in an unlink splice mode. In the link splice mode, movement of a transition between adjoining segments maintains the segments as being adjoining by adjusting the lengths of both of the segments. However, in the unlink splice mode, movement of a transition results in the length of one of the segments being modified while its adjoining segment retains its original length.

These modes of operation are illustrated in *Figure 3*, which illustrates the operation of the system but does not reflect the way in which the information is actually displayed on the visual display unit **108**.

An original splice or cut is illustrated at **301**, an edit to this cut in link splice mode is shown at **302** and a similar edit in unlink splice mode is shown at **303**. At **301** a segment **304** from a first source has been spliced to a similar segment **305** from a second source. Regions **304** and **305** represent the actual video frames that will be displayed in the original output material. In order for edits to be effected upon these clips, it is necessary for adjoining frames to be included such that the point at which the cut occurs may be advanced or retarded as is considered appropriate. Consequently, each segment, such as segment **304**, includes handles **306** and **307**. In this way, cut **308** representing the point at which segment **304** starts may be advanced by including additional frames within portion **304** taken from leading handle **306**. Similarly, cuts **309** between segments **304** and **305** may be retarded, with reference to segment **304**, by increasing the length of segment **304** by taking frames from the trailing handle **307**. Similarly, segment **305** is provided with a leading handle **310** and a trailing handle **311**.

In this example, it is assumed that an edit decision has been made to the effect that cut **309** should be moved from position **312** to position **313** as indicated by arrow **314**. In the link splice mode of operation, cut **309** is selected and moved to position **315** as shown at **302**. This results in trailing handle **307** being increased while leading handle **310** is reduced. Clearly, the extent to which this cut may be moved in the direction of arrow **314** will depend upon the length of leading handle **310** and appropriate capture hints may be given during the capturing process to ensure that edits of sufficient size may be effected.

In some circumstances, it may be desirable to modify segment **304** without making any changes to adjoining segment **305**. Under these circumstances the unlink splice mode of operation may be selected as illustrated at **303**. Again, segment **304** is selected for editing such that its duration is reduced and frames previously contained within segment **304** are effectively transferred to the segment's trailing handle **307**. However, as shown at **303** in the unlink splice mode, the length of segment **305** remains unchanged and the length of its leading handle **310** also remains unchanged. This effectively results in a gap **316** being introduced between what were previously adjoining clips **304** and **305**.

In the preferred embodiment, blank frames are introduced into a gap such that the edited results may be previewed at step **205**. Subsequently, new material may be introduced into this gap or other appropriate editing functions may be performed. However, the unlink splice mode of editing has ensured that modifications effected to segment **304** do not result in any modifications being made to segment **305**.

An example of images displayed on visual display unit **108** is shown in *Figure 4*. Video images for preview purposes are shown within a window **401** and a particular image clip may be displayed at video rate in response to soft button **402** of the graphical user interface being selected. Soft button **403** allows new segments of video to be introduced, possibly as a result of effects

being generated as on-line operations.

Linked splice editing may be selected by activation of button **404** with unlinked splice editing being selected in response to deactivation of button **404**. An additional Link Transition mode of editing may be selected by activation of soft button 405. Thus the soft button interface illustrated in Figure 4 provides a possibility of four modes of operation: Link Splice and Link Transition both off; Link Splice on with Link Transition off; Link Splice off with Link Transition on, and Link Splice on with Link Transition on.

In the example shown in *Figure 4*, link splice editing has been selected, resulting in button **404** being highlighted as illustrated by boundary **406**. In response to link splice editing being selected a cursor **407** of an appropriate colour is displayed and said cursor moves in response to manual movement of the stylus **107**.

In response to movement of the stylus **107**, cursor **407** moves allowing a particular edit cut, such as cut **408** to be selected. The cut is edited by placing the stylus **107** into pressure and while held in this state, the cut point can be moved in the direction of arrows **409**. Thus, in this way, the cut is displayed as movement horizontally in either direction to perform a link splice edit as illustrated at **302**.

A similar situation is shown in *Figure 5* in which the link splice button **404** is deselected. Upon deselecting the link splice button, a differently coloured cursor is displayed on the monitor, which may consist of a single arrow **502**. The direction of arrow **502** indicates which of the two video segments will actually be modified. In the example shown in *Figure 5*, the arrow is directed towards the left such that segment **503** is edited while segment **504** remains unchanged. As shown in *Figure 5*, the edit cut has been moved to the left, resulting in a gap **505** being introduced between segments **503** and **504**.

The processing system **104** is configured to store segment data and the structure of this data is illustrated in *Figure 6*.

Edit decision list data received by the system is converted into a track **601**. Within the track file particular segments are named by a segment name **602**. In the example shown in *Figure 6*, segment name **602** identifies "segment 075" with segment name "segment 076" being identified at **603**.

Segment data associated with segment name **602** is shown at **604** with similar data with respect to segment 076 being shown at **605**. For the purposes of this example, it is assumed that segment **304** shown in *Figure 3* is derived from segment data **604** and segment **305** is derived from segment data **605**.

The segment data contains a total of six timecodes **606**, **607**, **608**, **609**, **610**, **611**. Timecode **606** represents the start of the clip in memory and would therefore represent the earliest timecode of leading handle **306**. Similarly, timecode **607** represents a last frame stored in memory and as such is represented by the highest timecode of trailing handle **307**.

Timecodes **608** and **609** represent the proportion of the video clip which is actually being contained in the output. Thus, timecode 608 represents the first frame of segment **304** with timecode **609** representing the last frame of this segment.

An output clip derived from the segments shown in *Figure 6* is illustrated in *Figure 7A*. The output clip runs from 00:23:14:08 (abbreviated to 14:08) to 15:23. Frames 14:08 to 14:22 are derived from reel 52 with frames 14:23 to 15:23 being derived from reel 17.

The effect of a 10 frame link splice edit to the left is illustrated in *Figure 7B*. The output clip still commences at 14:08 and ends at 15:23. However, the edit point has been moved to the left, in link splice mode, such that reel 52 now terminates at frame 24:09 with reel 17 commencing at frame 51:23.

A similar edit in unlinked splice mode is illustrated in *Figure 7C*. Again, the output portion of the clip is written to output frames 14:08 to 15:23 the system being such that 24 frames are present within each second of a clip. The same editing action is performed such that the cut point is moved 10

frames to the left and the clip taken from reel 52 finishes at frame 24:08. However, the start of reel 17 remains at frame 52:09 and the 10 intermediate frames **701** are effectively left blank and are derived from copies of a null frame.

Procedures for performing an edit are illustrated in *Figure 8*. At step **801** activation of a pointing device, such as a mouse click or the putting of a stylus into pressure, is detected.

At step **802** the selected edit is identified in terms of the edit cut point. At step **803** movement data is obtained representing movement of the edit cut point and in response to this movement the segment data is updated at step **804**. At step **805** a question is asked as to whether the pointing device has been de-activated and if this question is answered in the negative control is returned to step **803**.

Eventually, the editor will position the cut point at the required position resulting in the question asked at step **805** being answered in the affirmative, thereby allowing the edited material to be previewed in accordance with step **205**.

The updating of segment data at step **804** will result in a function call, the exact nature of which will depend upon whether link splice mode or unlink splice mode has been selected.

The appropriate function for link splice mode is illustrated in *Figure 9*.

At step **901** the movement data is converted into a frame movement FM and at step **902** a question is asked as to whether the movement has been to the left. If answered in the affirmative, the reducing segment, that is the segment to the left, is reduced by the frame movement FM at step **903**. Similarly, the increasing segment to the right is updated by the frame movement at step **904**.

If the question asked at step **902** is answered in the negative, to the effect that the edit position has been moved to the right, the reducing segment, to the right, is updated at step **905** and the increasing segment to

the left is updated at **906**.

The effect of the function shown in *Figure 9* upon the track data shown in *Figure 6*, is illustrated in *Figure 10*. Steps **903**, **904**, **905** and **906** result in segment data being identified within a track file and updated in accordance with the specified edit, such as the example shown in *Figure 7A*. Thus, the particular segments being edited are known to the process resulting in an appropriate index being generated into the track file **601**. Within the track file the particular segment data under consideration is identified and the particular timecode is similarly indexed within the segment portion. Following this procedure, as shown in *Figure 10*, the timecode at location at **609** is reduced by ten frames as shown at **1003**. Similarly, the start of the output timecode is reduced by ten frames as shown by **1004**.

In accordance with the link splice mode of operation, as a clip length is reduced in response to an edit cut being removed, its adjoining clip is increased. Consequently, reel 17 starts at timecode 51:23 as shown at **1005** with output frames being written to position 14:13 as shown at **1006**.

Similar modifications would be effected if the question asked at step **902** were answered in the negative. This would result in all the modified timecodes being increased instead of being decreased.

Procedures **804** for up-dating segment data in un-link splice mode are detailed in *Figure 11*. At step **1101** the frame movement FM is identified at and step **1102** a question is asked as to whether this movement is to the left. If answered in the affirmative, control is directed to step **1103**, alternatively control is directed to step **1107**.

At step **1107** the reducing left segment data is up-dated and at step **1104** the question is asked as to whether a blank segment has been introduced. If this question is answered in the negative, a blank segment is created at step **1105** whereafter at step **1106** the blank segment data is itself up-dated. If the question asked at step **1104** is answered in the affirmative, control is directed to step **1106**.

Similarly, if the question asked at step **1102** is answered in the negative, to the effect that the movement is been to the right, the right segment data is up-dated at step **1107**. The question is then asked as to whether a blank segment has been introduced at step **1108** and if answered in the negative control is directed to step **1109**. At step **1110** the blank segment is up-dated and control is then directed to step **805**. If the question asked at step **1108** is answered in the affirmative, the existing blank segment data is up-dated at step **1110**.

The effect of using the function detailed in *Figure 11* as defined by the edit detailed in *Figure 7C* is shown in *Figure 12*. Segment 075 is updated substantially as for the previous edit in that the timecode at **609** is reduced to 24:09 and the timecode at **611** is reduced to 14:12.

The data contained within segment 076 is unmodified but re-numbered as segment 077 with a new segment 076 being introduced to contain the blank data. Thus, the blank data segment (new 076) would be introduced in response to operation **1105** with frames being taken from a notional reel 500 containing ten hours of blank data. In practice, all of these frames would be obtained from the same frame source but the numbering of notional timecodes maintains the integrity of the system. Blank frames 00:01 to 00:10 effectively become part of the output over the range 14:13 to 14:22. Prior to this, up to 14:12, frames are derived from reel 52 and after this, from 14:23, frames are derived from reel 17.

In the preferred embodiment, an additional mode of operation is provided by activation of the Link Transition soft button 405 as illustrated in Figures 4 and 5. A transition segment defines a process for smoothly transferring from outgoing to incoming segments. A transition segment is defined, that overlaps outgoing and incoming segments, and the Link Transition mode affects how this transition segment responds to splice editing operations. The Link Transition mode of operation is illustrated in *Figure 13*. An original splice or cut is illustrated at **1301**. An edit to this cut in

unlinked transition mode is shown at **1302**, and a similar edit in link transition mode is shown at **1303**. At **1301**, a segment **1304** from a first source has been spliced to a similar segment **1305** from a second source. A shaded region **1351** defines a transition segment, which combines frames from both outgoing and incoming segments **1304** and **1305** respectively. The transition segment **1351** enables a sequence of overlapping frames to be defined, during which a transition effect may be applied. A typical transition effect is the application of a crossfade or dissolve. More complex transition processes include iris effects, with the incoming image appearing in the centre of the screen, and progressively opening up to fill the screen by the end of the transition segment **1351**.

The handles **1306**, **1307**, **1310** and **1311** on each segment provide the frames that are required for transition effects, as well as ensuring that sufficient frames are available when moving a splice point in linked mode, as indicated at **302** in *Figure 3*. An example of moving the end of segment **1304** in unlinked mode, while a transition effect is applied, is shown at **1302**. In this example, segment **1304** ends before the transition effect commences. Consequently, the transition effect results in a crossfade from black frames to the frames of segment **1305**. The example shown at **1302** is useful, as it enables additional material to be inserted in the gap that remains, with the transition effect automatically taking effect upon the newly inserted segment without the need for further editing operations.

An example of performing the same splice movement in link transition mode is shown at **1303**. In this example, the transition segment **1351** has moved with the splice point. In the unlinked transition mode, the transition segment is unlinked to the splice point. Thus, the transition segment will remain fixed in position on the timeline, until deliberately moved, regardless of the movements of splice points that are carried out with respect to other segments.

The examples hitherto described have made the assumption that modification of a start or end to a segment results in a selection of a different frame in the segment being selected as the first or final frame. In an alternate mode of operation, modification of a splice point or start or end point of a segment does not result in a different frame being selected, in other words, an entire sequence of frames in the modified segment or segments will be shifted in time. This is illustrated in *Figure 14*. At **1401** an outgoing segment **1404** is spliced at **1407** with an incoming segment **1405**. The first frame of the incoming segment **1405** is indicated at **1406**. In the mode of operation universally assumed in previous examples, the result of moving a linked splice point to the right is shown at **1402**. In this instance the first frame **1406** of the incoming segment **1405** has been shifted into the handle of the incoming segment **1405**, and the remainder of the frames in that segment remain in the same position with respect to the timeline. At **1403**, the same splice operation has been carried out in the alternate mode of operation where the frames of segments are fixed in position relative to the splice point **1407**. In this instance, the first frame of the incoming segment **1405** is still frame **1406**, although the splice point has moved. Thus, it will have been necessary to shift all frames in the segment with respect to the splice point.

In a further alternate embodiment, gaps created as a result of moving a splice in unlinked mode are considered as segments themselves, with appropriate manipulations being applicable thereto. Furthermore, the default setting of blank, black frames may be modified by the user to frames having any desired specifiable characteristic.

Claims

1. Apparatus for editing image data representing a plurality of image frames, comprising

storage means for storing segment data;

output means for displaying image frames in response to said segment data;

visual display means for displaying visual elements representing adjoining image segments in response to said segment data;

manual input means for selecting and adjusting transitions between adjoining segments such that said segment data is modifiable in response to said adjustments; and

processing means configured to selectively operate in a linked mode or in an unlinked mode, such that

in said linked mode movement of a transition between adjoining segments maintains said segments as being adjoining by adjusting the lengths of both of said segments, and

in said unlinked mode movement of a transition results in the length of one of said segments being modified while its adjoining segment retains its original segment length.

2. Apparatus according to claim 1, wherein said storage means is configured to store a data block for each segment, including a start time and an end time for said segment.

3. Apparatus according to claim 2, wherein said processing means is configured to update two data blocks when segments are linked and said processing means is configured to update only one data block when said segments are un-linked.

4. Apparatus according to any of claims 1 to 3, wherein said processing means is configured to convert movement data into representations of timecode.

5. Apparatus according to any of claims 1 to 4, wherein said processing means is configured to change displayed attributes depending upon the mode of operation.

6. A method of editing image data representing a plurality of image frames, comprising steps of

storing segment data;

displaying image frames in response to said segment data;

displaying visual elements representing adjoining image segments in response to said segment data;

selecting and adjusting transitions between adjoining image segments such that said segment data is modifiable in response to said adjustments; and

selectively operating in a linked mode or in an un-linked mode, such that

in said linked mode movement of a transition between adjoining segments maintains said segments as being adjoining by adjusting the lengths of both of said segments, and

in said un-linked mode movement of a transition results in the length of one of said segments being modified while its adjoining segment retains its original segment length.

7. A method according to claim 6, wherein a data block is stored for each segment and each data block includes a segment start time and a segment end time.

8. A method according to claim 7, wherein two data blocks are updated when operating in said linked mode but only one data block is updated when operating in said un-linked mode.

9. A method according to any of claims 6 to 8, wherein movement data is converted into representations of timecode.

10. A method according to any of claims 6 to 8, wherein an attribute of a displayed icon is changed in dependence upon a selected mode of operation.

11. A computer readable medium having computer-readable instructions executable by a computer such that said computer performs the steps of:

storing segment data representing image frames;

displaying image frames in response to said segment data;

displaying visual elements representing adjoining image segments in response to said segment data;

selecting and adjusting transitions between adjoining image segments such that said segment data is modifiable in response to said adjustments; and

selectively operating in a linked mode or in an unlinked mode, such that

in said linked mode movement of a transition between adjoining segments maintains said segments as being adjoining by adjusting the lengths of both of segments, and

in said unlinked mode movement of a transition results in the length of one of said segments being modified while its adjoining segment retains its original segment length.

12. A computer readable medium according to claim **11**, wherein said computer-executable instructions include additional instructions for performing the step of storing each segment with data including a segment start time and a segment end time.

13. A computer readable medium according to claim **12**, wherein said computer-executable instructions include additional instructions for updating two data blocks when operating in said linked mode or updating one data block when operating in said unlinked mode.

14. A computer readable medium according to claim **11**, wherein said computer-executable instructions include additional instructions for converting movement data into representations of timecode.

15. A computer readable medium according to claim **11**, wherein said computer-executable instructions include additional instructions for changing an attribute of a displayed icon in dependence upon a selected mode of operation.

16. In a computer system having a graphical user interface including a display and a user interface selection device, a method of performing editing operations upon image frames, comprising steps of

displaying image frames in response to stored segment data;

displaying visual elements representing adjoining image segments in response to said segment data;

selecting and adjusting transitions between adjoining image segments by operation of said user interface device such that segment data is modifiable in response to said adjustments; and

selectively operating in a linked mode or in an unlinked mode, such that

in said linked mode movement of a displayed transition between adjoining segments maintained said segments as being adjoining by adjusting the lengths of both of said segments, and

in said unlinked mode movement of a displayed transition results in the length of one of said segments being modified while its adjoining segment retains its original segment length.

17. A method according to claim **16**, wherein an attribute of a displayed icon is changed in dependence upon a selected mode of operation.

18. Apparatus for editing image data substantially as herein described with reference to the accompanying drawings.

19. A method of editing image data substantially as herein described with reference to the accompanying drawings.

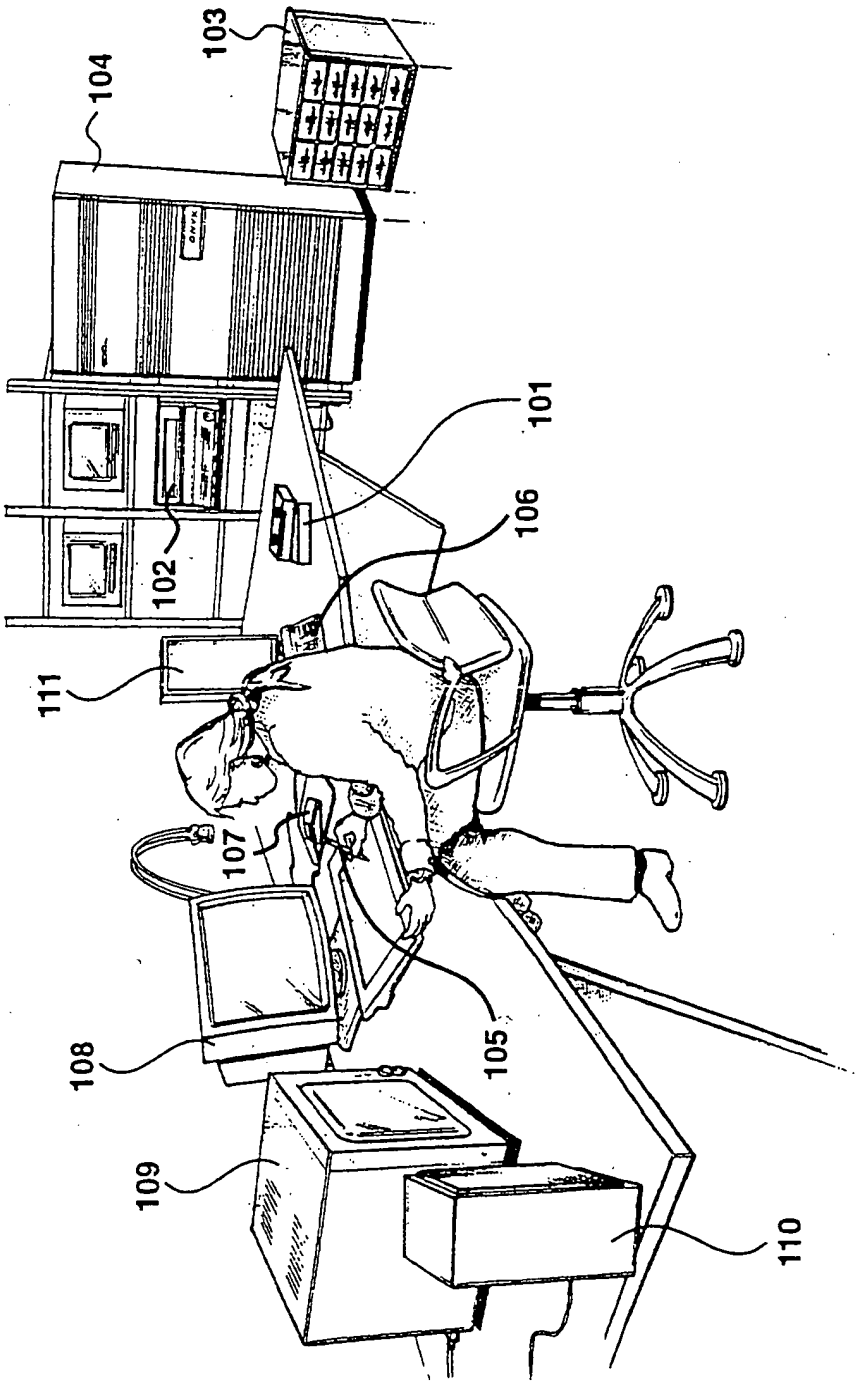

Figure 1

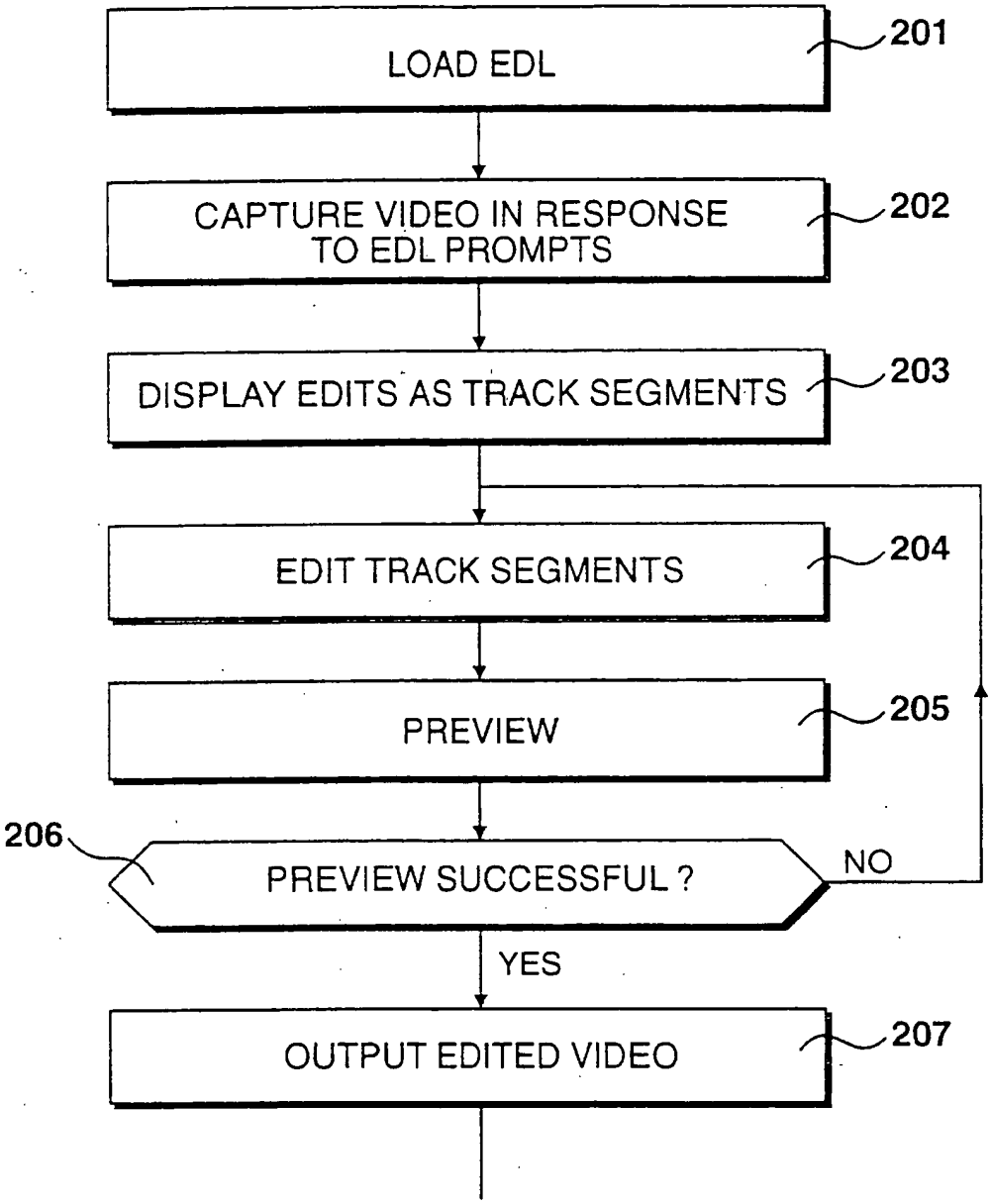
LOAD EDL
201
CAPTURE VIDEO IN RESPONSE TO EDL PROMPTS
202
DISPLAY EDITS AS TRACK SEGMENTS
203
EDIT TRACK SEGMENTS
204
PREVIEW
205
206
PREVIEW SUCCESSFUL ?
NO
YES
OUTPUT EDITED VIDEO
207

Figure 2

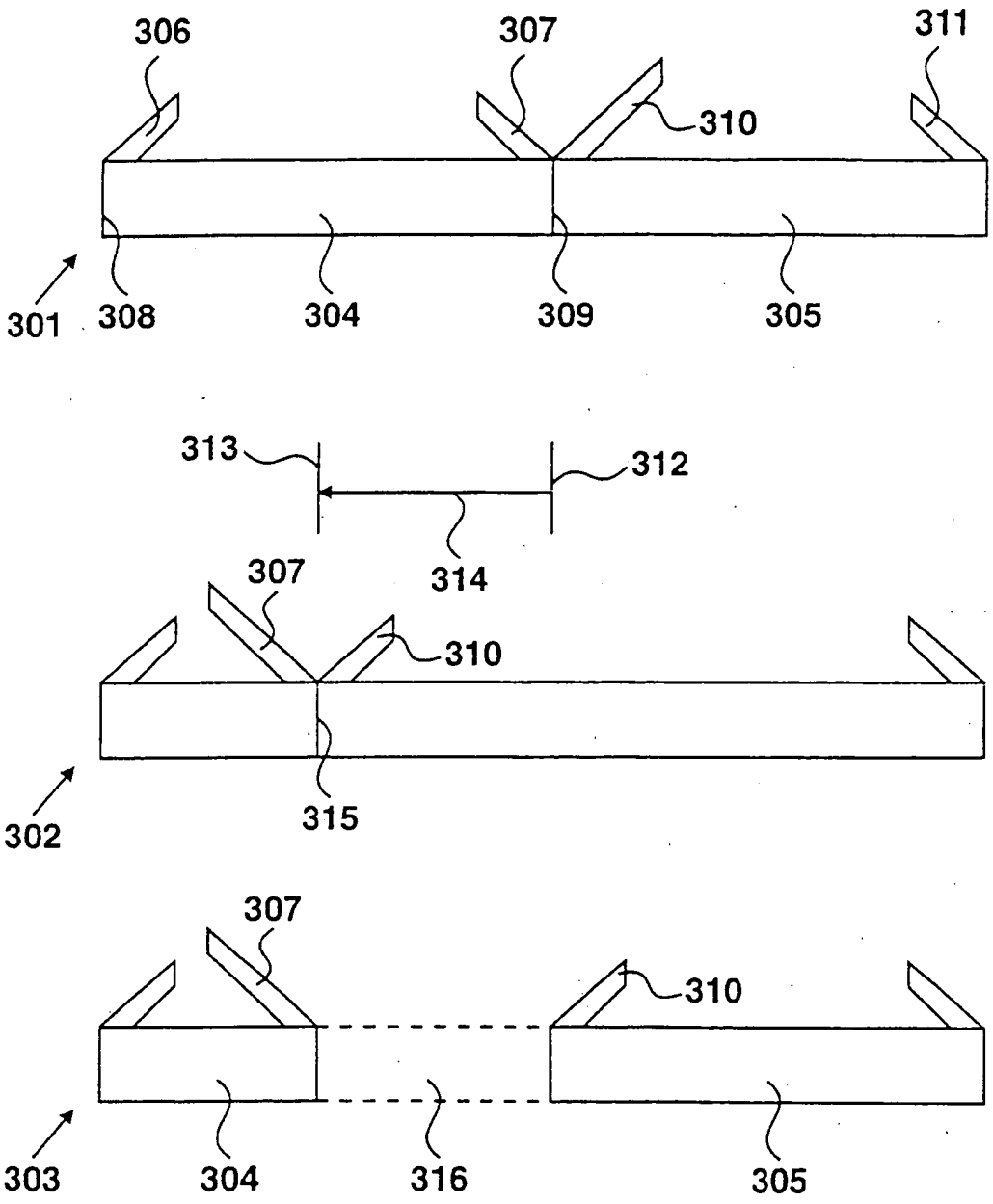
306
307
311
310
301
308
304
309
305
313
312
314
307
310
302
315
307
310
303
304
316
305

Figure 3

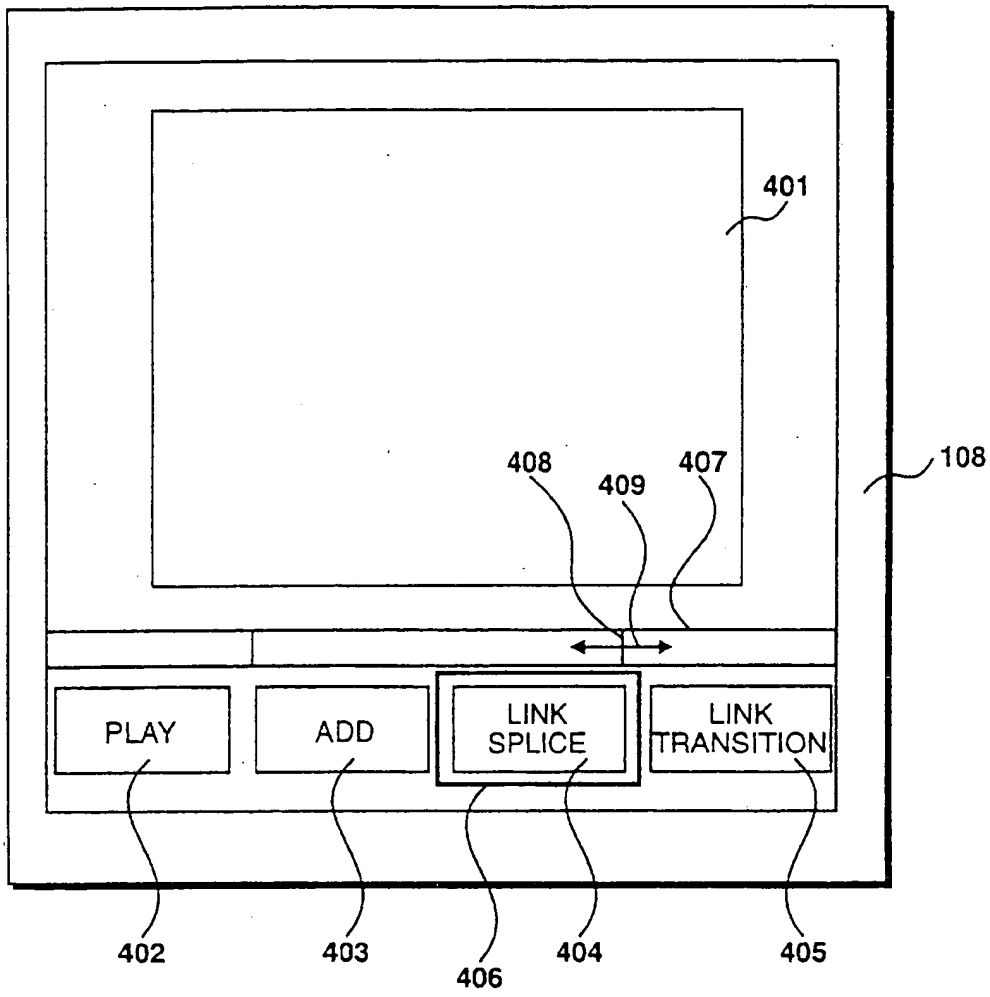
401
408
409
407
108
PLAY
ADD
LINK SPLICE
LINK TRANSITION
402
403
406
404
405

Figure 4

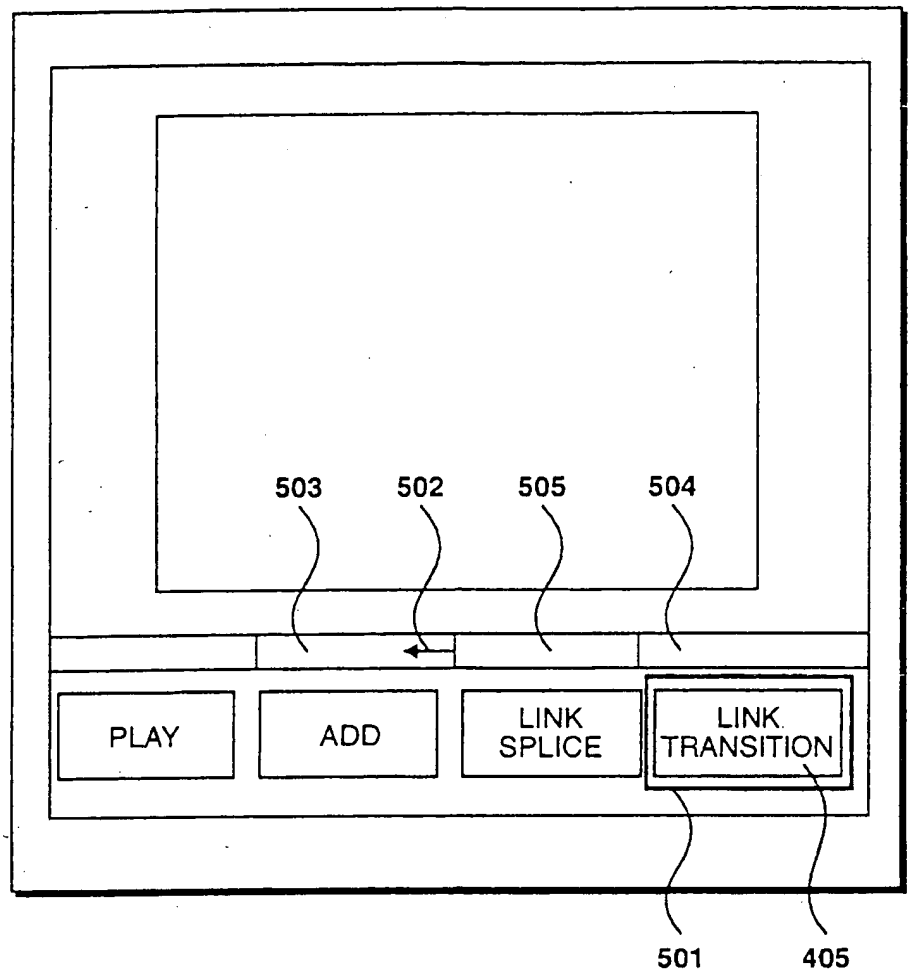

Figure 5

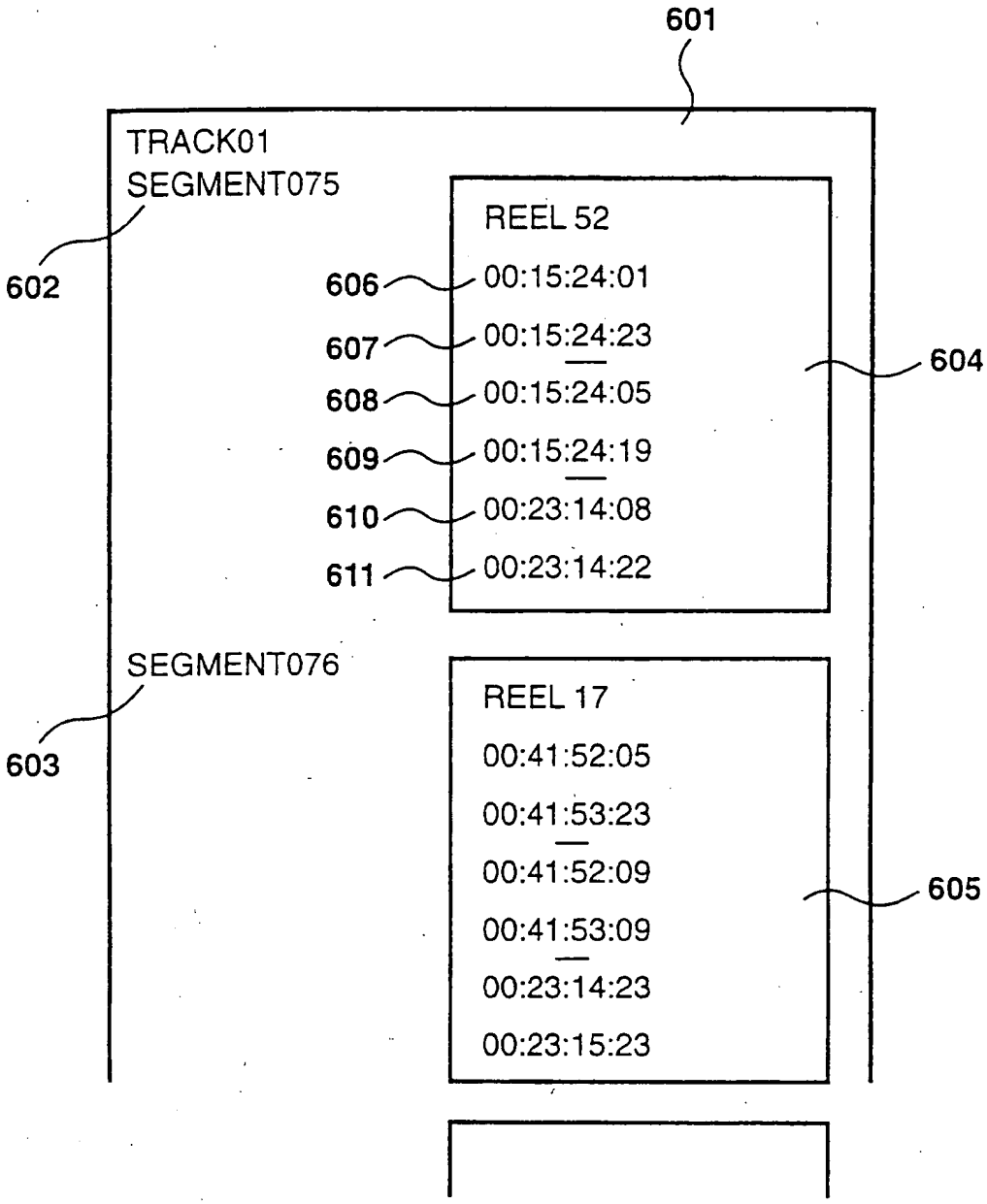
601
TRACK01
SEGMENT075
602
REEL 52
606
00:15:24:01
607
00:15:24:23
608
00:15:24:05
609
00:15:24:19
610
00:23:14:08
611
00:23:14:22
604
SEGMENT076
603
REEL 17
00:41:52:05
00:41:53:23
00:41:52:09
00:41:53:09
00:23:14:23
00:23:15:23
605

Figure 6

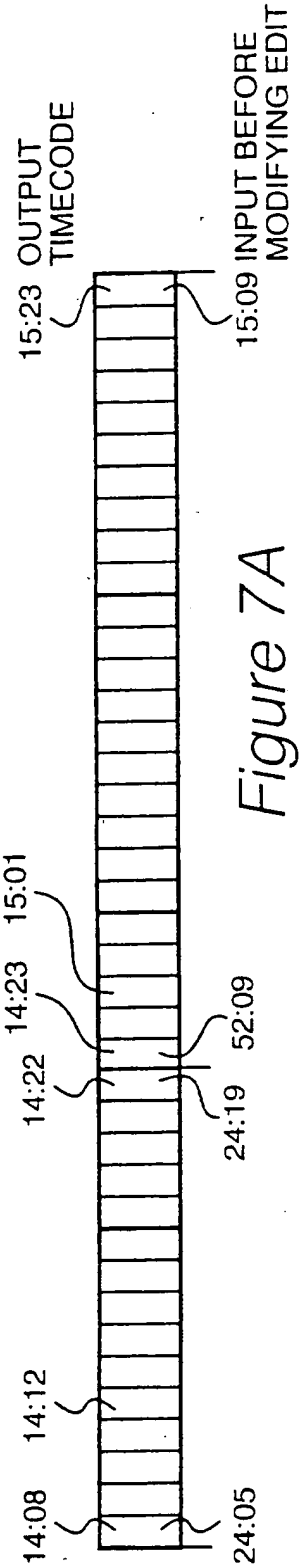

Figure 7A

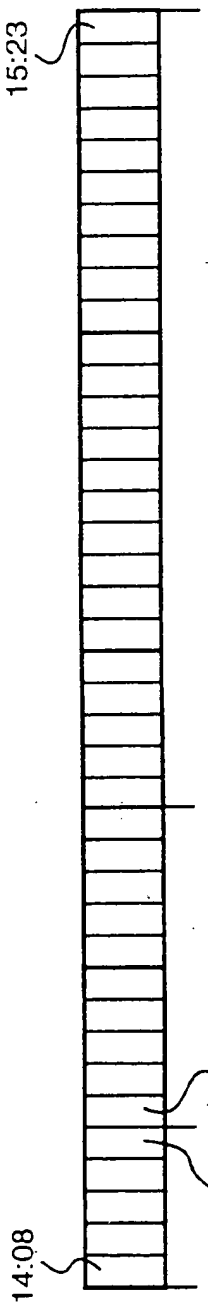

Figure 7B

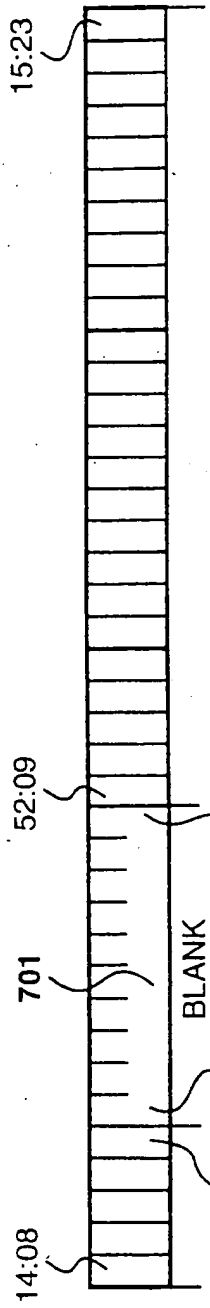

Figure 7C

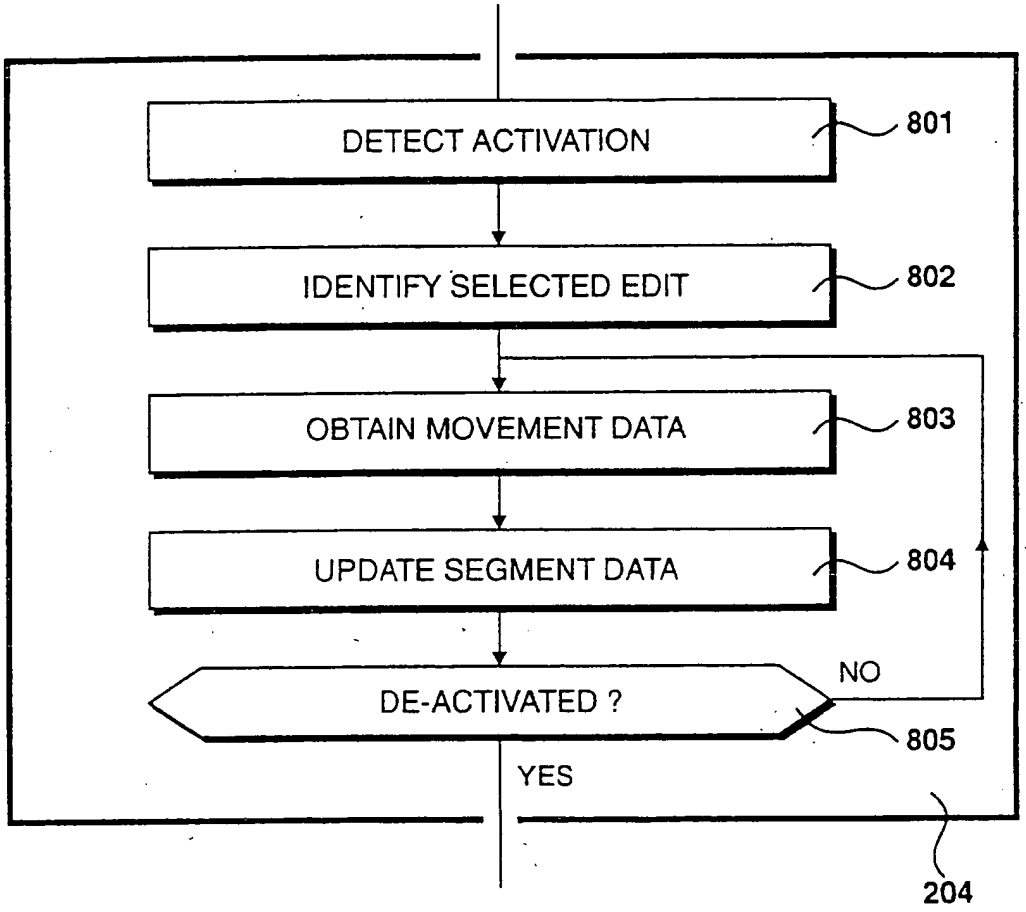
DETECT ACTIVATION
801
IDENTIFY SELECTED EDIT
802
OBTAIN MOVEMENT DATA
803
UPDATE SEGMENT DATA
804
DE-ACTIVATED ?
NO
805
YES
204

Figure 8

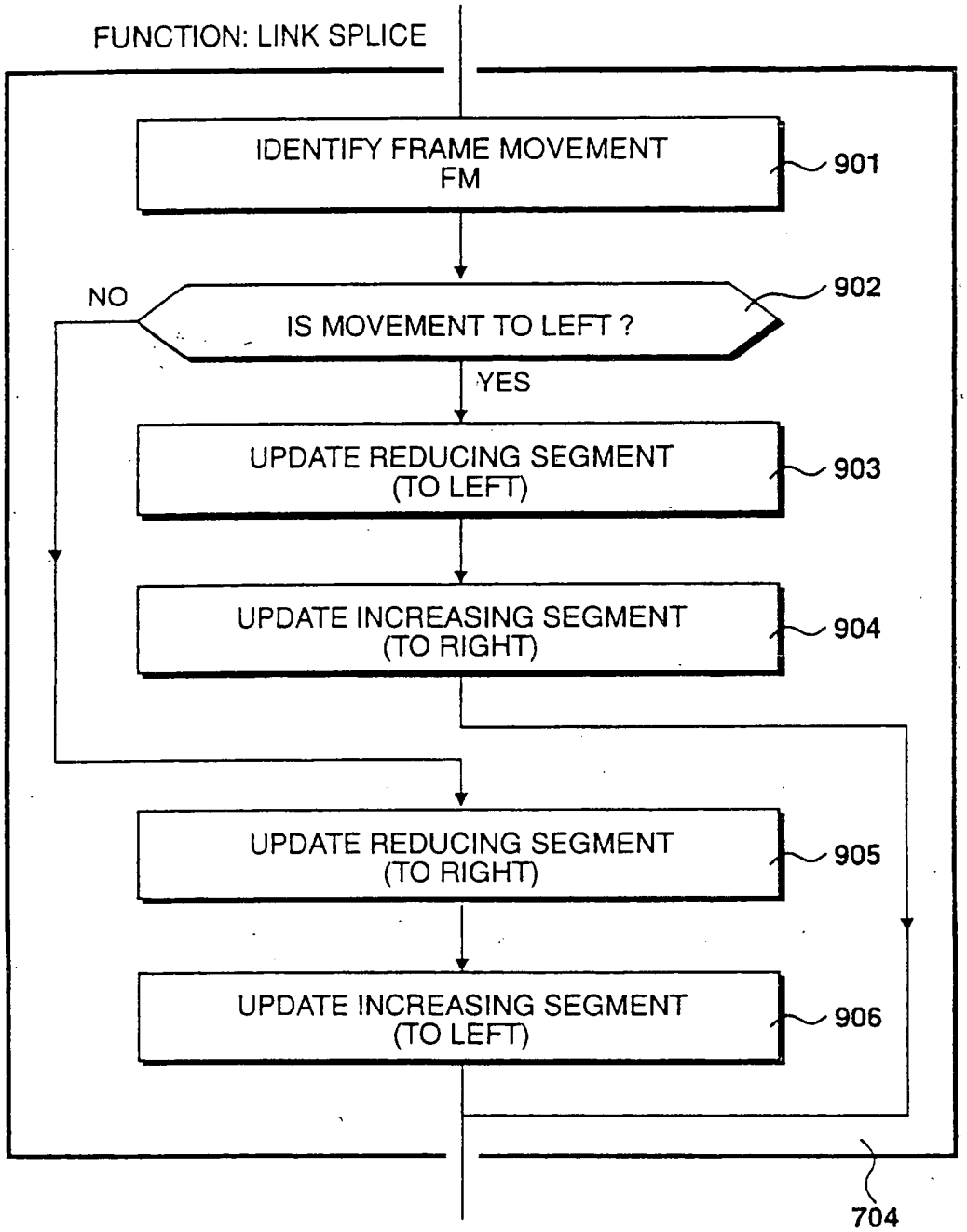
FUNCTION: LINK SPLICE
IDENTIFY FRAME MOVEMENT FM
901
NO
IS MOVEMENT TO LEFT ?
902
YES
UPDATE REDUCING SEGMENT (TO LEFT)
903
UPDATE INCREASING SEGMENT (TO RIGHT)
904
UPDATE REDUCING SEGMENT (TO RIGHT)
905
UPDATE INCREASING SEGMENT (TO LEFT)
906
704

Figure 9

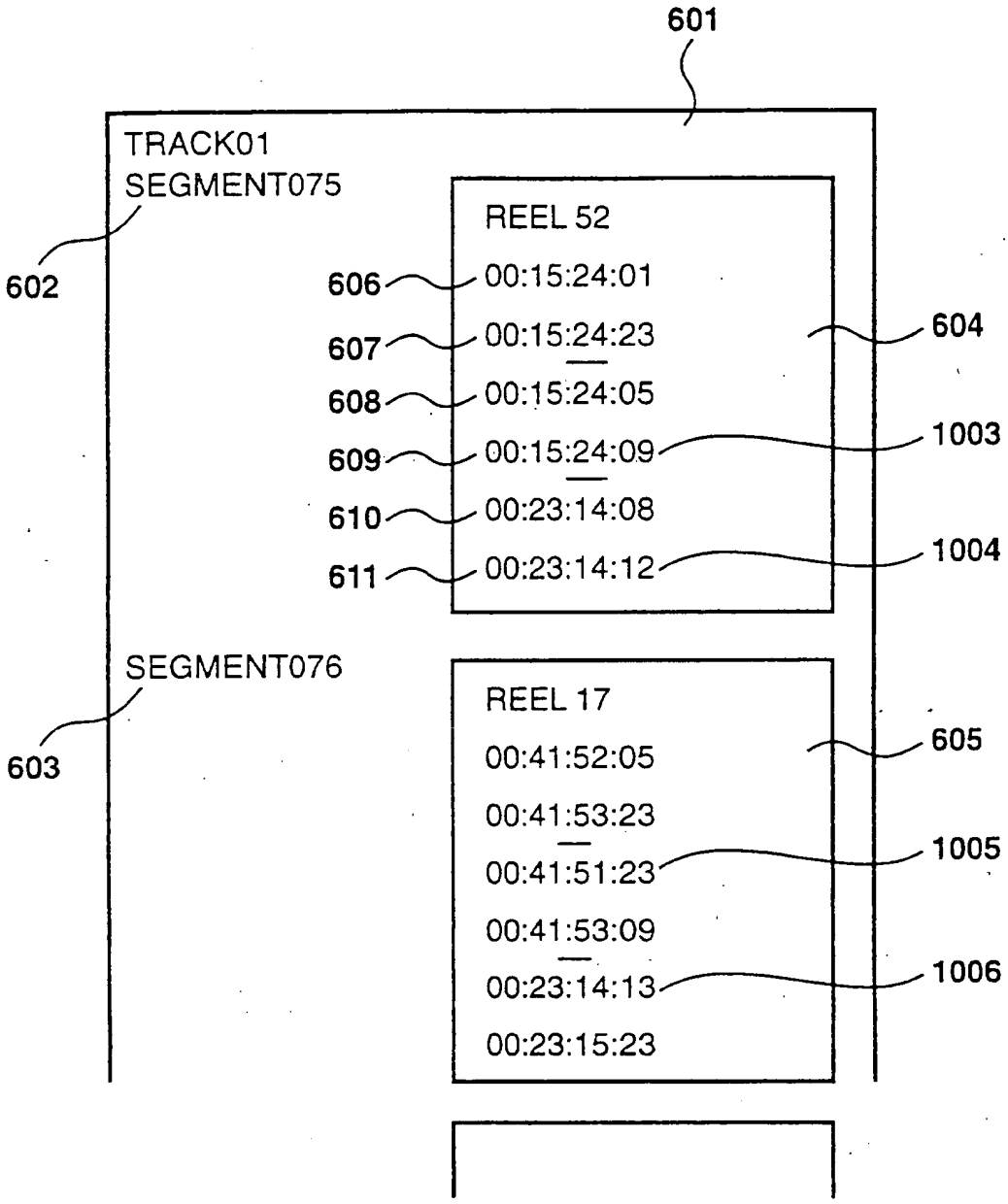
601
TRACK01
SEGMENT075
602
REEL 52
606
00:15:24:01
607
00:15:24:23
604
608
00:15:24:05
609
00:15:24:09
1003
610
00:23:14:08
611
00:23:14:12
1004
SEGMENT076
603
REEL 17
605
00:41:52:05
00:41:53:23
1005
00:41:51:23
00:41:53:09
1006
00:23:14:13
00:23:15:23

Figure 10

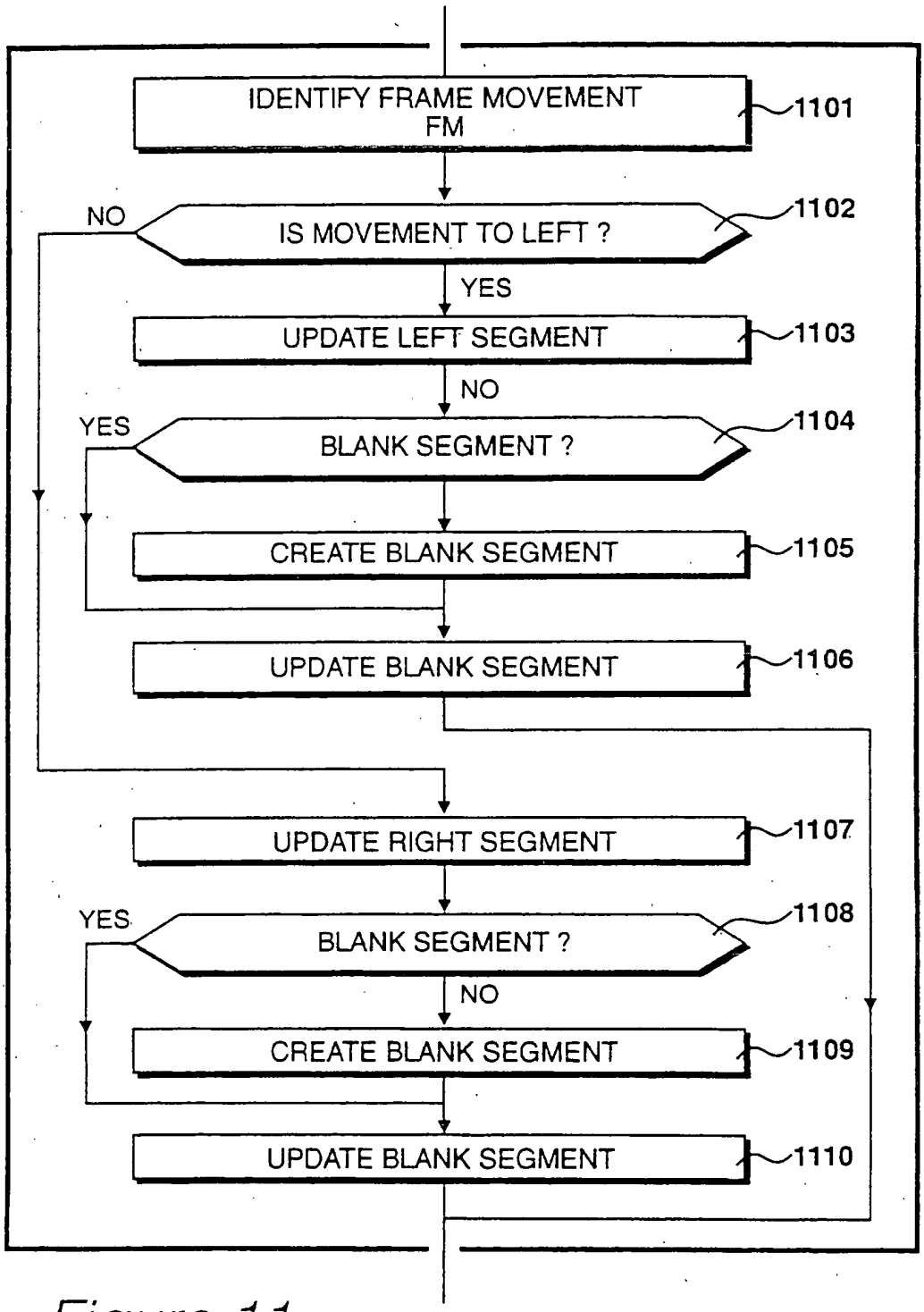
IDENTIFY FRAME MOVEMENT FM
1101
NO
IS MOVEMENT TO LEFT ?
1102
YES
UPDATE LEFT SEGMENT
1103
NO
YES
BLANK SEGMENT ?
1104
CREATE BLANK SEGMENT
1105
UPDATE BLANK SEGMENT
1106
UPDATE RIGHT SEGMENT
1107
YES
BLANK SEGMENT ?
1108
NO
CREATE BLANK SEGMENT
1109
UPDATE BLANK SEGMENT
1110

Figure 11

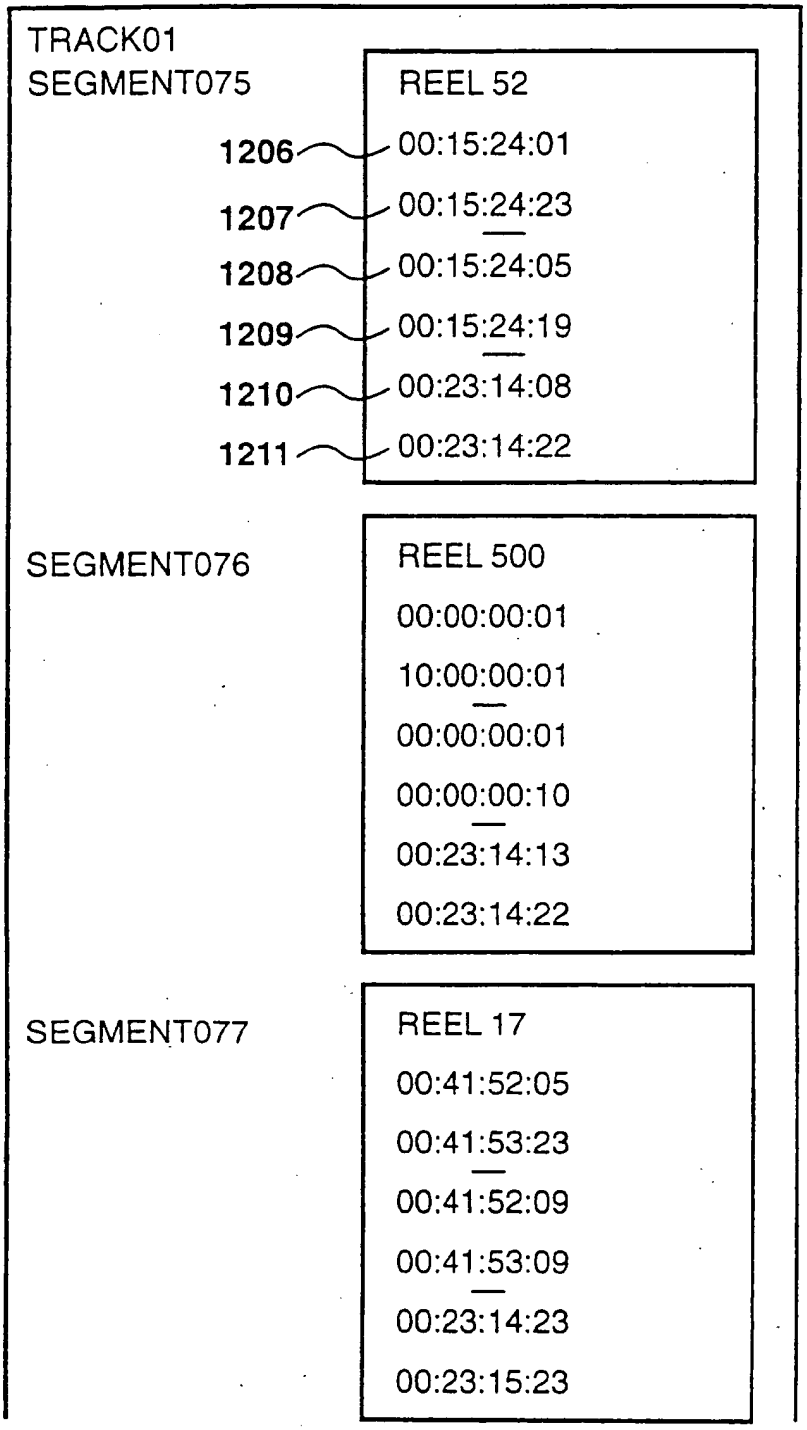
TRACK01
SEGMENT075
REEL 52
1206
00:15:24:01
1207
00:15:24:23
1208
00:15:24:05
1209
00:15:24:19
1210
00:23:14:08
1211
00:23:14:22
SEGMENT076
REEL 500
00:00:00:01
10:00:00:01
00:00:00:01
00:00:00:10
00:23:14:13
00:23:14:22
SEGMENT077
REEL 17
00:41:52:05
00:41:53:23
00:41:52:09
00:41:53:09
00:23:14:23
00:23:15:23

Figure 12

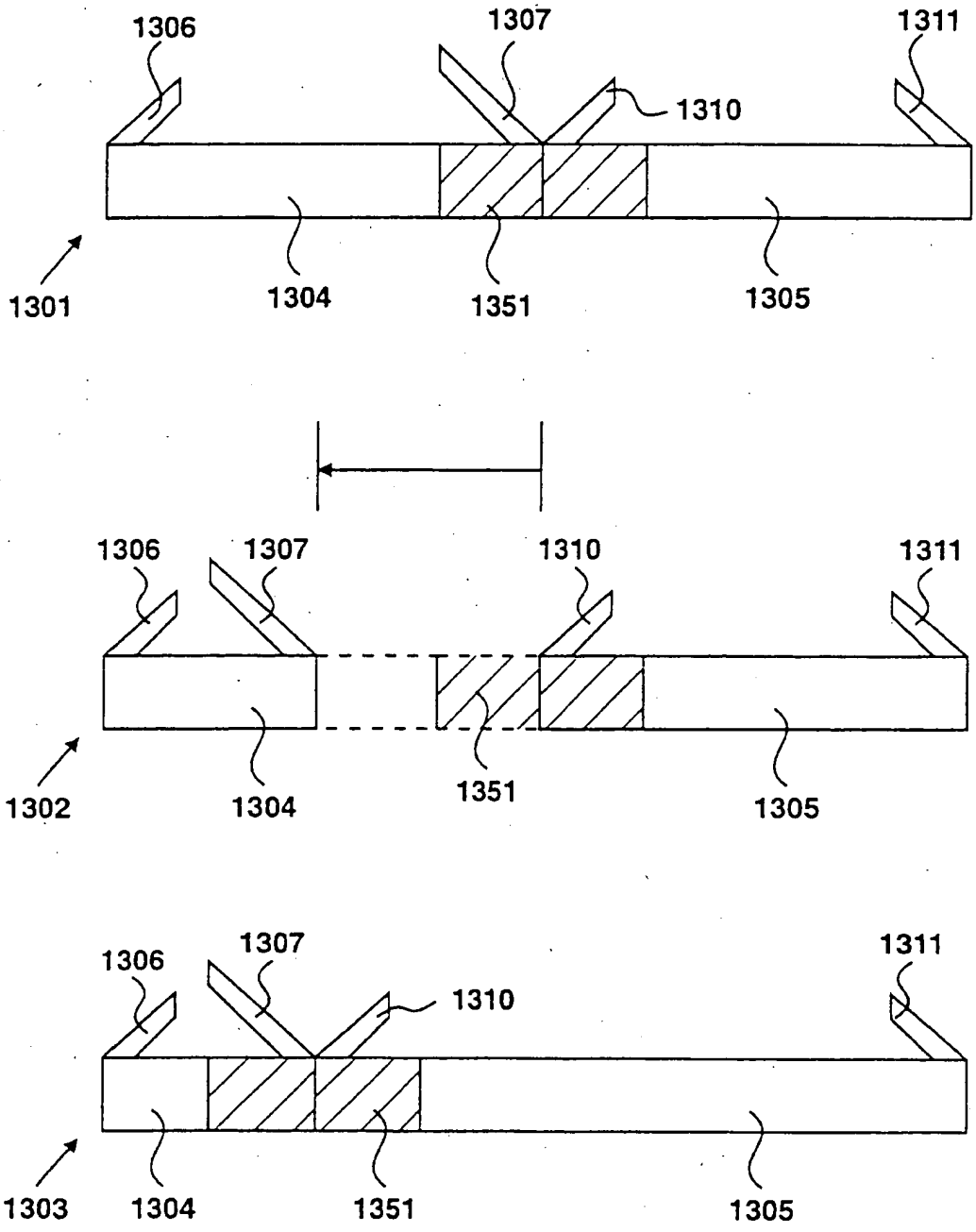
1306
1307
1311
1310
1301
1304
1351
1305
1306
1307
1310
1311
1302
1304
1351
1305
1306
1307
1310
1311
1303
1304
1351
1305

Figure 13

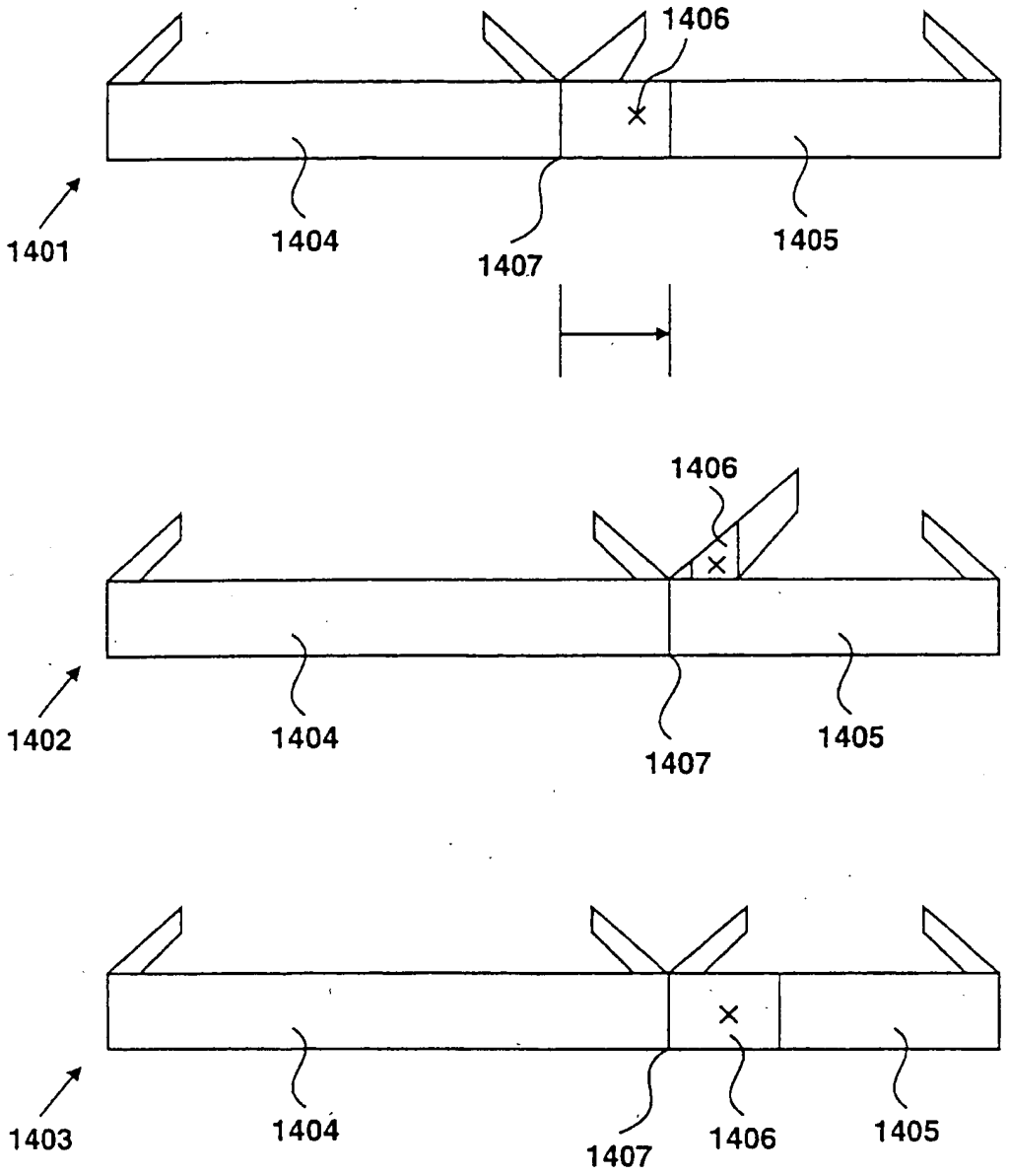
1406
1401
1404
1407
1405
1406
1402
1404
1407
1405
1403
1404
1407
1406
1405

Figure 14